Minnegram Spring 2014

Director's Corner

- Spring 2014 Director's Corner

Features

- Baseflow Restoration in Minnehaha Creek Watershed with Stormwater Infiltration

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  The USGBC of Minnesota approached UMD Continuing Education about developing an online educational course focusing on stormwater management. In response to this request, UMD Continuing Education partnered with Jesse Schomberg from the Minnesota Sea Grant program to design the Stormwater Management in Cold Climates course. While this course was designed for LEED professionals, anyone interested in gaining a better understanding of the issues related to stormwater management will benefit.

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ring 2014 Director's Corner

I don't think I am that unusual in that when I am on vacation, I am especially interested in issues that are part of my day to day work. So when I recently visited historic Jamestown, I spent time exploring the area, contemplating the James River, which appeared to be impacted by sediment, and the land adjacent to the river. Members of the Powhatan tribe had been living in the area prior to 1607 and likely used the river and the land for their livelihood. I wondered if the river looked the same back in 1607 and earlier or was cleaner. When Europeans arrived, the same river was important for both native residents and Europeans for drinking, bathing, crops, cooking, transportation and probably waste disposal. Today, we use water in many of the same ways, but our understanding of the importance of water has increased with new science. We also have learned from our past practices that clean and abundant water resources aren't a given. The spring issue of the Minnegram highlights a few areas where we continue to search for answers, including research into human waste, runoff, and stormwater management. The Water Resources Center continues to support water research, so that occupants of the land in 400 years can have access to water resources for their sustenance.

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seflow Restoration in Minnehaha Creek Watershed with Stormwater Infiltration

By: Ryan Birkemeier, Water Resources Science graduate student in Department of Bioproducts and Bioengineering

Roughly three years ago, John Nieber of the Department of Bioproducts and Bioengineering and John Gulliver of the Department of Civil Engineering submitted a grant request to the Minnehaha Creek Watershed District (MCWD) and the Mississippi Watershed Management Organization (MWMO) to investigate the lack of water in dry years throughout Minnehaha Creek. Minnehaha Creek is arguably one of the most valued surface water features in the Minneapolis, MN metro area and is heavily used for recreation during the spring, summer, and fall. Flow in Minnehaha Creek is heavily dependent on discharge from the stream's origin, Lake Minnetonka, the outlet of which is closed during most late summer periods to maintain water elevations in the lake resulting in low- (or no-) flow conditions in the creek. In addition, stormwater runoff entering directly to the creek from the creek's largely urbanized watershed exacerbates extremes in flow conditions. As a result of these issues, there was interest in enhancing the cultural and ecosystem services provided by Minnehaha Creek through improvements in streamflow regime by reducing flashiness and sustaining increased low-flows.

The grant request to investigate low-flow conditions within Minnehaha Creek was accepted by the MCWD and the MWMO and work began in the spring of 2012. A post-doctoral researcher at the time, Trisha Moore (now Assistant Professor at Kansas State University), was charged with the task of identifying 'losing' areas (net flow of surface water to groundwater) and 'gaining' areas (net flow of groundwater to surface water) along the creek. This involved identification and quantification of the current sources of water contributing to low-flows in the creek through both field investigations and desktop analyses. Work on this source identification involved a number of different approaches, including analyses of the streamflow record using a hydrologic system model framework, examination of the underlying geology of the region, estimation of groundwater-surface water exchange rates within the channel and riparian corridor using temperature probe, seepage meter, and piezometer measurements, and analyses of the stable isotopes of oxygen and hydrogen in samples of stream water,

groundwater, and rainfall. Due to this large workload, several undergraduate students were involved throughout the course of the project to help with fieldwork tasks and Water Resources Science graduate student, Ryan Birkemeier was added to the team in July of 2013 to expand upon and support existing work.

A draft report of results was submitted to MCWD and MWMO in December of 2013. The most recent results indicate that only a small portion of the catchment, probably the riparian zone, contributes to baseflows in Minnehaha Creek. These results appear to be supported by the observation that the low-vertical permeability limestone/shale bedrock layer underlying the surficial aquifer has been eroded away in past geological events in about 9% of the watershed, leading to a bedrock valley located in the chain-of-lakes area near Lake Calhoun and Lake Harriet. This eroded area essentially leaves the surficial aquifer 'bottomless' in that area and highly susceptible to vertical (downward) water loss. In addition, the analysis of the stable isotopes indicates that much of the low flow volume originates from surface storage including wetlands and small lakes within the watershed, rather than a groundwater source. The isotope analysis indicates that only about 5% of the surficial aquifer recharge water actually makes it to the creek; the rest is apparently lost to deep seepage. The groundwater-surface water exchange measurements along the main channel throughout the watershed show a 'gaining' trend in the upper reaches and a 'losing' trend in the lower reaches. To address the issue of low groundwater contribution to low-flows in the creek it has been proposed to divert stormwater to key locations within the riparian zone along the creek, and to infiltrate that water and store it for slow release to the creek during dry or no-precipitation periods. Work will continue over the upcoming months to investigate and provide solutions for low-flow conditions within Minnehaha Creek. An eventual goal is maintenance of flows throughout the watershed to improve recreational opportunities and stream habitat.

Joe Magner (Department of Bioproducts and Biosystems Engineering), Trisha Moore (Kansas State University) also contributed to this project.

For more information, visit St. Anthony Falls Laboratory Stormwater Research

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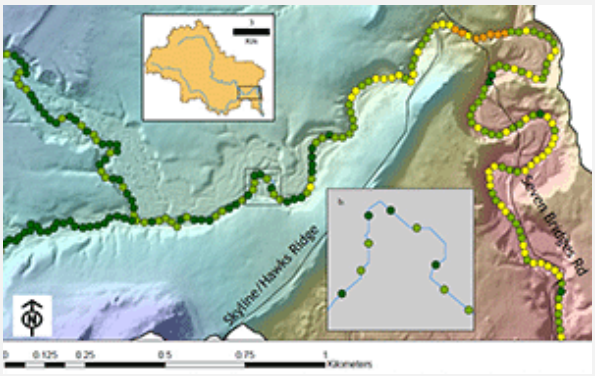
Three principal investigators (PIs) and their USGS-funded projects were chosen to receive the student grants.

Mae Davenport (FR, WRS faculty), “Building Sustainable Governance Framework to sustainably Manage Minnesota’s Water Resources.” The project will determine the variables that influence local watershed governance within the Cannon River watershed and develop an interactive model to explore how governance impacts both users and the hydrological system. The study will also provide input on conservation practice decision-making in the Red River Basin and will implement a landowner survey. The salary grant will fund a student working on a new follow-on project identifying drivers and constraints to the adoption of agricultural conservation practices through the previously developed survey tool. “The grant will enable us to manage the survey, conduct in-depth analysis and tailor the project recommendations to local stakeholders in study watershed districts and across the entire basin. We will also be able to host an interactive workshop where stakeholders can learn about project findings and begin to develop and prioritize action steps,” said Davenport.

Brandy Toner (SWC, WRS faculty) “Stratigraphic Distribution and Mineralogical Sources of Arsenic to Minnesota Glacial Aquifers.” Toner continues to work on the geological settings and geochemical processes that release arsenic to glacial aquifers in Minnesota. Arsenic is present in many wells across Minnesota and state regulators need to develop a better set of criteria for well drillers, and Toner’s research will contribute valuable information to this task. The salary award will fund a Ph.D. student as she completes her dissertation.

Karen Gran (Geology UMD, WRS faculty) will expand her WRRI-funded research “Predicting Erosional Hotspots in North Shore Streams from High-resolution Datasets.” Eight to ten additional watersheds will be studied using recent LiDAR data. Water Resources Science (WRS) graduate Molly Wick started the project, doing some hydrologic conditioning of aerial LiDAR data on a series of North Shore watersheds. The award will assist current WRS student Tiffany Sprague as she expands the LiDAR data into Duluth area watersheds.



Stream power along Amity Creek in eastern Duluth, calculated from a 1m lidar-derived DEM. Greens indicate low stream power, while yellows and oranges indicate high stream power. Stream power was calculated as a function of upstream area and channel slope and is one factor that goes into the erosion hotspot model.

Figure adapted from Wick, 2013

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TP program makes recommendations to improve septic system management at adult foster care homes

The wet wipes clogging the equipment that University of Minnesota's Onsite Sewage Treatment Program researchers use to study septic system effectiveness were the first clue as to why systems serving adult foster homes experience system failure at a greater rate than other residential treatment systems. Results of a study conducted by staff from the University of Minnesota's Onsite Sewage Treatment Program at six foster homes in Chisago county show that adult foster care homes produce wastewater that is different than typical residential wastewater, with higher levels of contaminates that may contribute to decreased septic system performance. Bleach and other strong cleaning products for example, interfere with organisms required to break down solids in the wastewater.

Wet wipes were present in three of the studied sites; all the homes have residents who wear adult diapers. The wipes clogged OSTP sampling equipment and were deemed to be a risk to septic system pipes. "Best practices would be to dispose of the wipes with other solid wastes rather than flushing them," says the study's lead PI, Sara Heger.

Heger also pointed out above average water flow at several of the studied homes as a problem for system longevity, stirring up solids in pretreatment tanks and creating ponding in the soil treatment area. The resulting surface discharge threatens the surrounding environment and can create a human health hazard. Frequency of laundering linens and clothing appeared to be the greatest culprit in the high wastewater output.

While the study concludes that septic output contamination levels are difficult to manage, adjustments by the caregivers in the home during their daily activities could reduce wastewater output and toxicity. Recommendations for these sites include installing water saving devices, limiting the use of personal care products, cleaners and sanitizers, using natural cleaners, and educating staff and residents about proper disposal of non-organic material. In addition, many of the systems need updating to meet current treatment and dispersal requirements. When upgrades are made on these facilities, the addition of

advanced treatment should be considered to assist in the removal of pharmaceuticals, personal care products and organic material prior to the soil treatment area.

More detailed information on this study can be found on the OSTP website: www.septic.umn.edu/research/

Photo credit: Sara Heger

Items not intended for processing in septic systems or too much use of one product can cause premature system failure. Here, paper products block the inlet baffle on a septic tank, interfering with the system's ability to break down human waste.

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w Online Course: Stormwater Management in Cold Climates

(This course is no longer available as of 2016) Reprinted with permission from the SeicheMinnegram Spring 2014 stormwater image Editor's note: Course development for Stormwater Management in Cold Climates included work from WRS faculty Val Brady, Gerald Niemi, Rich Axler and George Host, as well as John Bilotta and Northland Nemo.

Stormwater management is studied by city planners, civil engineers, architects, landscape designers, contractors, residential builders, facilities managers, building owners, property managers, local code officials, and educators. Many of these professionals are LEED (Leadership in Energy & Environmental Design) certified by the USGBC (United States Green Building Council).

The USGBC of Minnesota approached UMD Continuing Education about developing an online educational course focusing on stormwater management. In response to this request, UMD Continuing Education partnered with Jesse Schomberg from the Minnesota Sea Grant program to design the Stormwater Management in Cold Climates course. While this course was designed for LEED professionals, anyone interested in gaining a better understanding of the issues related to stormwater management will benefit.

This self-paced, online course is divided into four units. The first unit focuses on the concept of hydrology in relation to stormwater, the second compares watershed samples and their impact on the selected area, the third evaluates water quality and quantity issues in the selected area, and the final unit explores the impact of stormwater runoff and how it affects lakes, streams, and watersheds. The cost of the Stormwater Management in Cold Climates course is $95. Participants can

begin the course at any time and have up to six months to complete it.

The course was approved by the Green Building Certification Institute for four CE hours toward LEED credential maintenance. It is also certified by the American Institute of Architects (AIA) for four hours of continuing education. This course has taken on a national level of accessibility. Connections with the USGBC and AIA provide exposure for UMD and its Continuing Education Department on a national level, as well as a solution to real world problems.

Continuing Education plans to offer more courses for LEED professionals in the future. As Roxanne Richards, program development associate for Continuing Education stated, "This course responds to the needs and desires of the community and is exactly what Continuing Education is about — offering professional development opportunities and credentials that can be included on a resume. This online course provides outreach to adult learners and an opportunity for Continuing Education to partner with community organizations."

For more information, visit the UMD Continuing Education website.

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ring 2014 Community News

Minnesota Water Resources Conference Call for Abstracts

Deadline: Friday, May 9, 2014

The Minnesota Water Resources Conference presents innovative, practical, and applied water resource engineering solutions, management techniques, and current research about Minnesota's water resources.

Abstracts are due by **May 9, 2014** and must be submitted electronically to: www.wrc.umn.edu/waterconf. Clearly describe the work in 100-150 words, include a descriptive title, and list all authors and their affiliations. Abstracts received by will be reviewed and the submitter will be notified in June if the abstract is accepted.

Larry Baker (BBE, WRS faculty) attended a workshop on Human-Carbon Interactions in Urban Systems at the National Center for Atmospheric Research in October 16-18, 2013 at Boulder, Colorado and a Research Coordinating Network workshop "Phosphorus Research to Create a Sustainable Food System" in Tempe, Arizona, January 6-10, 2014. He also presented an invited talk (with coauthors **Sarah Hobbie** (WRS faculty, EEB), **Jaques Finlay** (WRS faculty, EEB), P. Kalinosky, and B. Janke) "Moving upstream to reduce urban stormwater phosphorus loading" at the American Geophysical Union Conference, December 9, 3013 in San Francisco, CA. Baker and Heidi Peterson presented a talk "P dynamics for the Albert Lea Lake watershed: implications for future P management" at the Minnesota Pollution Control Agency/BWSR. Drainage Management Team Meeting, on January 16, 2014. Baker and **Kristen Nelson** (WRS faculty, FR, FWCB) presented two talks at Washington County Water Consortium, November 6, 2013. **Diana Karwan** (FR) and **Robert Tipping** (Minnesota Geological Survey) have joined the Water Resource Sciences graduate program faculty. Tipping teaches Hydrogeology,and Hydrogeology Field Camp and Karwan teaches Research Problems: Forest Hydrology.

Euan Reavie (UMD-NRRI, WRS faculty) received $500,000 in funding to assess the long-term aquatic conditions of the St. Louis River estuary to inform efforts to remove its Area of Concern designation. **Rich Axler** (UMD-NRRI, WRS faculty) is co-

principal investigator on the project. The ecological and water quality trends from the last few decades will be described and compared to the long-term ecological history to quantify the extent that rehabilitation efforts, such as sewage treatments, have had on western Lake Superior's aquatic ecology. This research initiative is a combined funding effort by the Minnesota Pollution Control Agency and Minnesota Sea Grant.

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ring 2014 Student News

Mina Rahimi Kazerooni received her M.S. degree in November 2013. Kazerooni and her advisor, Calvin Alexander, Jr., published "Locating Sinkhole in LiDAR Coverage of a Glacio-Fluvial Karst, Winona County, MN" 13th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impact of Karst.

Leah Smith was awarded a 25 perscent Research Assistant position as the Assistant for the Graduate Review & Improvement Process (GRIP) in the Department of Organizational Leadership, Policy, and Development. Smith is advised by **John Gulliver** and **Joe Magner**.

Brad Gordon was awarded a Graduate Research Fellowship from the MN Drive Initiative for Global Food Supply. His research project is Impact of Vegetative Quality on Stream Bank Erosion and Wetland Storage. The fellowship covers stipend for one year and funds research. Gordon is advised by **Chris Lenhart**.

Welcome Weekend was held February 21-23, 2014 on the St Paul and Duluth campuses. Eleven potential M. S. and Ph. D. students visited campus and met with faculty members.

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ring 2014 Upcoming Events

May 1-2, 2014

The State of Water Conference

Cragnus Resort

Brainerd, MN

The 2014 State of Water Conference is a unique opportunity to:

- Network with other citizens interested in improving and protecting water resources
- Connect with resource professionals from around the state
- Gain technical insights
- Find opportunities to protect and restore your lake or river

Click here to visit the official Conference webpage>>

May 18-23, 2014

Joint Aquatic Sciences Meeting (JASM)

Portland, OR

Visit the JASM website for more information>>

May 26-30, 2014

IAGLR 57th Annual Conference on Great Lakes Research

Ecosystem in Transition

Hamilton, Ontario

For more information, visit http://iaglr.org/

October 14-15, 2014

Minnesota Water Conference

RiverCentre, St. Paul, MN

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